Joint Program Office
for Biological Defense

JPO-Bio Defense

Emerging Technologies and Potential Applications

2nd Annual National Symposium on Terrorism Preparedness

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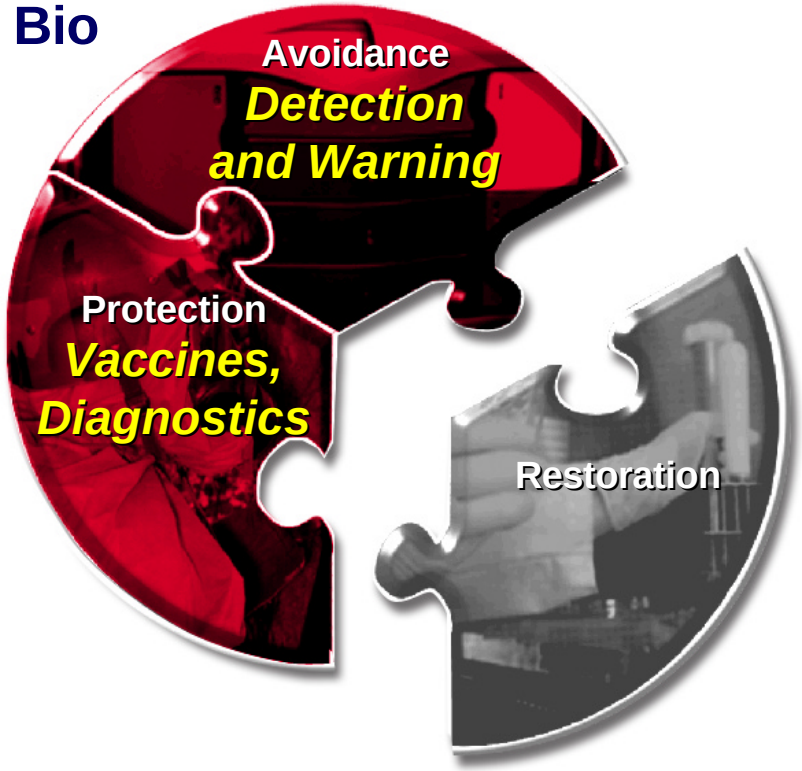
Charter for the Joint Program Office (April 1994)

Milestone Decision Authority (MDA) for Bio Defense (BD) Programs

- Manage BD Detection Programs
- Manage BD Medical Programs
- Monitor & Transition Emerging BD Technology



Attacks Can Take Many Forms, and be Greatly Influenced by Local Environment

Commercial Backpack Sprayer

Crop Dusting

Packages & Mail

Infected Individual

Biological Detection in Complex Environments Isn't Easy

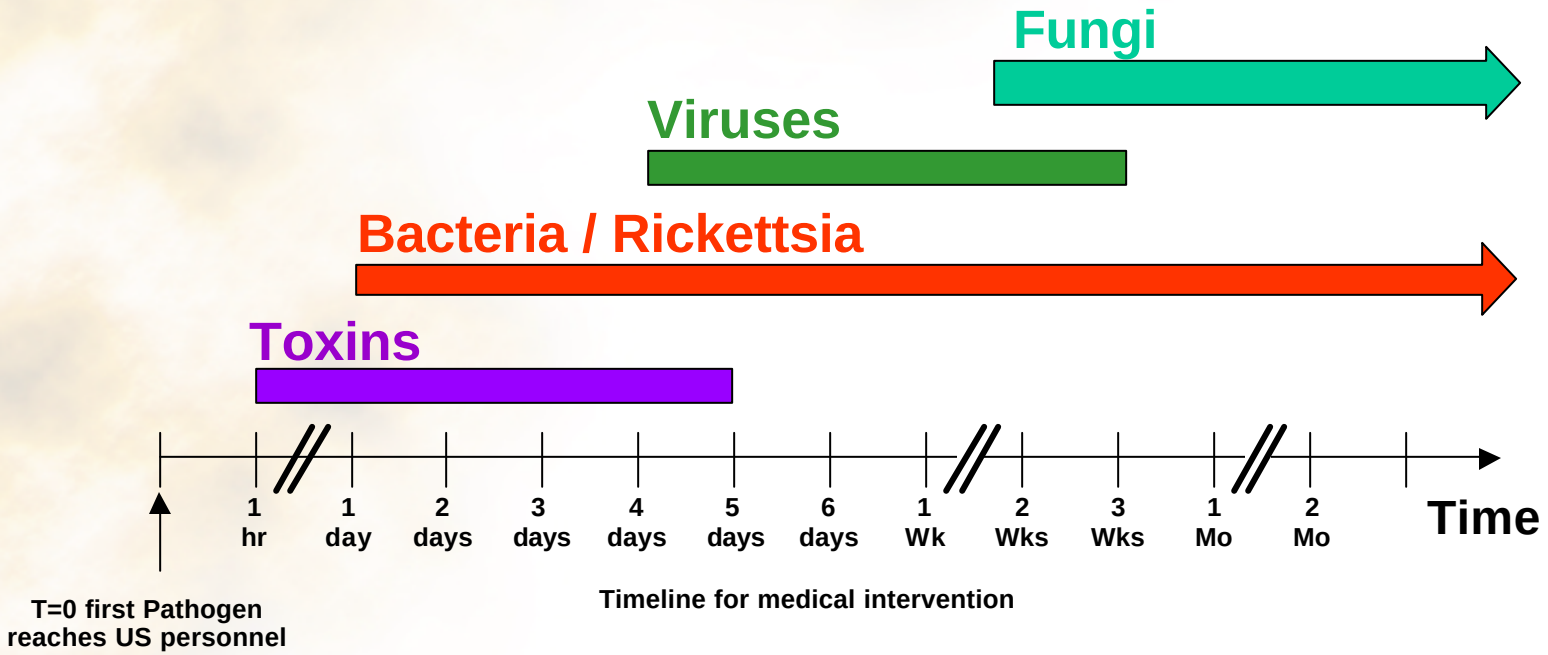
Challenges for Future Biological Detection

Institute for Defense Analysis Mission Area Analysis *(Jan 2000)*

- **Wide Range of Agents, Including Conventional Agents, Bioengineered Agents, Toxins, Bioregulators**
  - ***Required: Broad Spectrum Detection and Identification***
- **Increased Toxicity, Encapsulation**
  - ***Required: Very High Sensitivities***
- **Less Treatable Agents, Agents for Which There Are No Vaccines, Contagious Agents, Rapidly Acting Agents**
  - ***Required: Warning Prior to Significant Exposure***
- **More Stable Agents, Improved Covert Dissemination Means, (and Improved US Battlefield Awareness of Conventional Attacks)**
  - ***Required: More Emphasis on Covert Attacks (Non-covert Attacks May Be Ameliorated by Non-materiel Doctrinal Solutions)***
- **Technical Characteristics, Scope of Threat Must Be Decided!**
  - **Lethality, Particle Size, Purity, Survivability, Dissemination Efficiency, etc., etc.**

EXPANDING MISSIONS
Biological Detection

Medical & Detection Synergy for Survival on the Battlefield



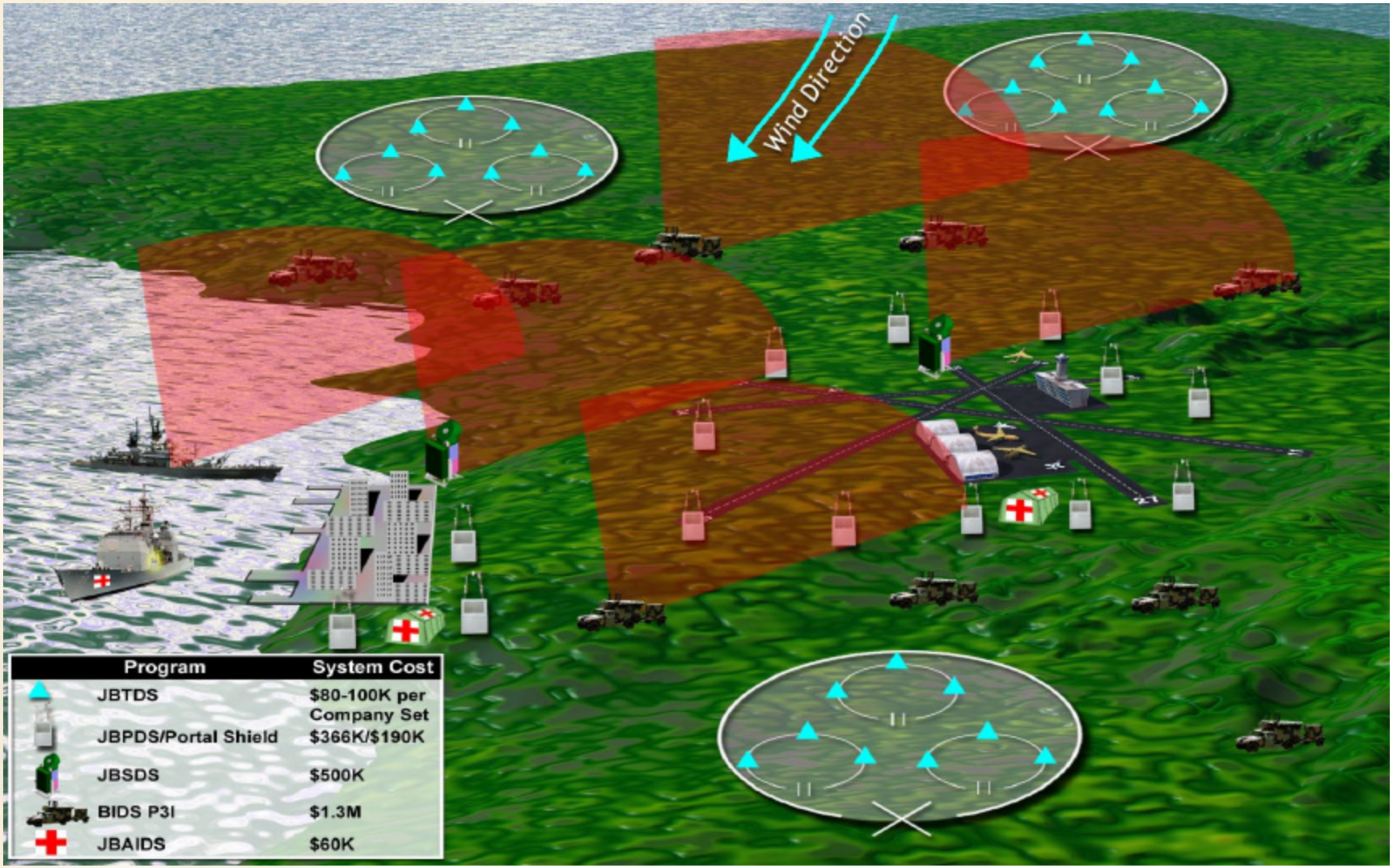
This is not Chemical Warfare…

"Detect to Treat" is a Good Thing!

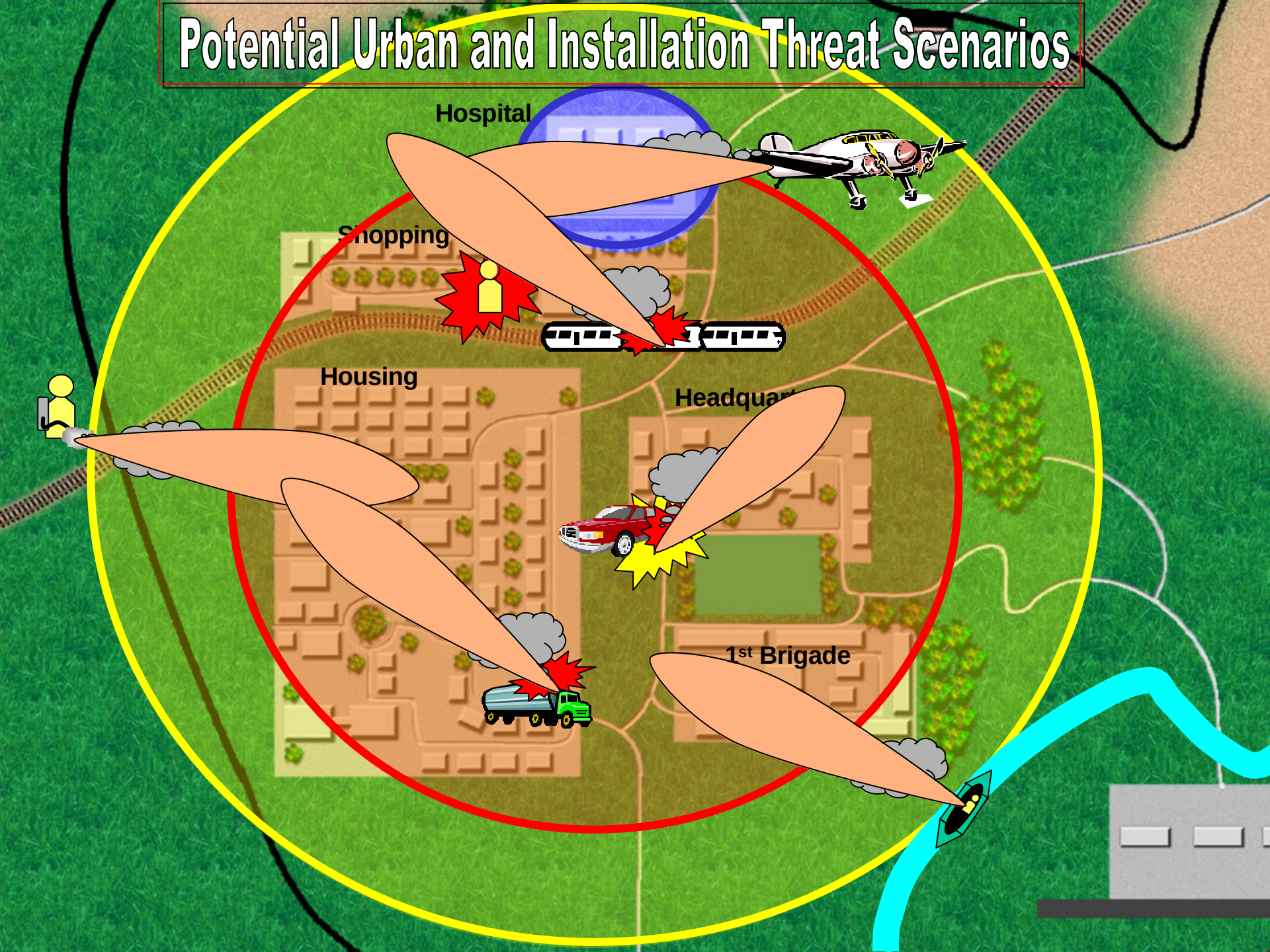
Layered Complementary Technologies

- Non-Specific Detection
  - Manmade Cloud From Naturally Occurring
- Generic Detection
  - Bio Versus Non-Bio (e.g. Dust)
- Specific Detection
  - Anthrax Versus Plague, etc.
- Point Detection
- Standoff Detection

Bio Detection Strategy- Integrated/Overlapping



Potential Urban and Installation Threat Scenarios

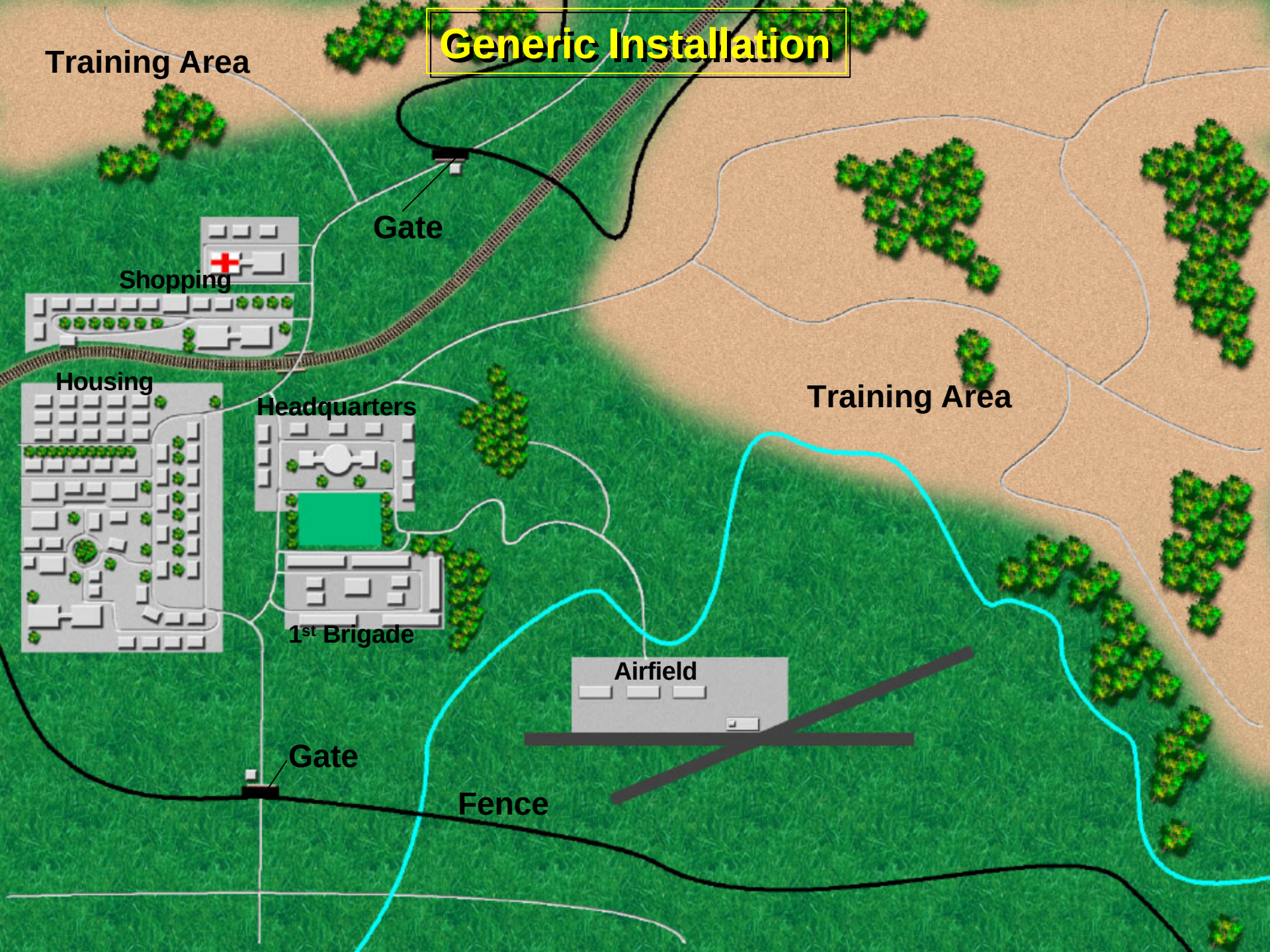


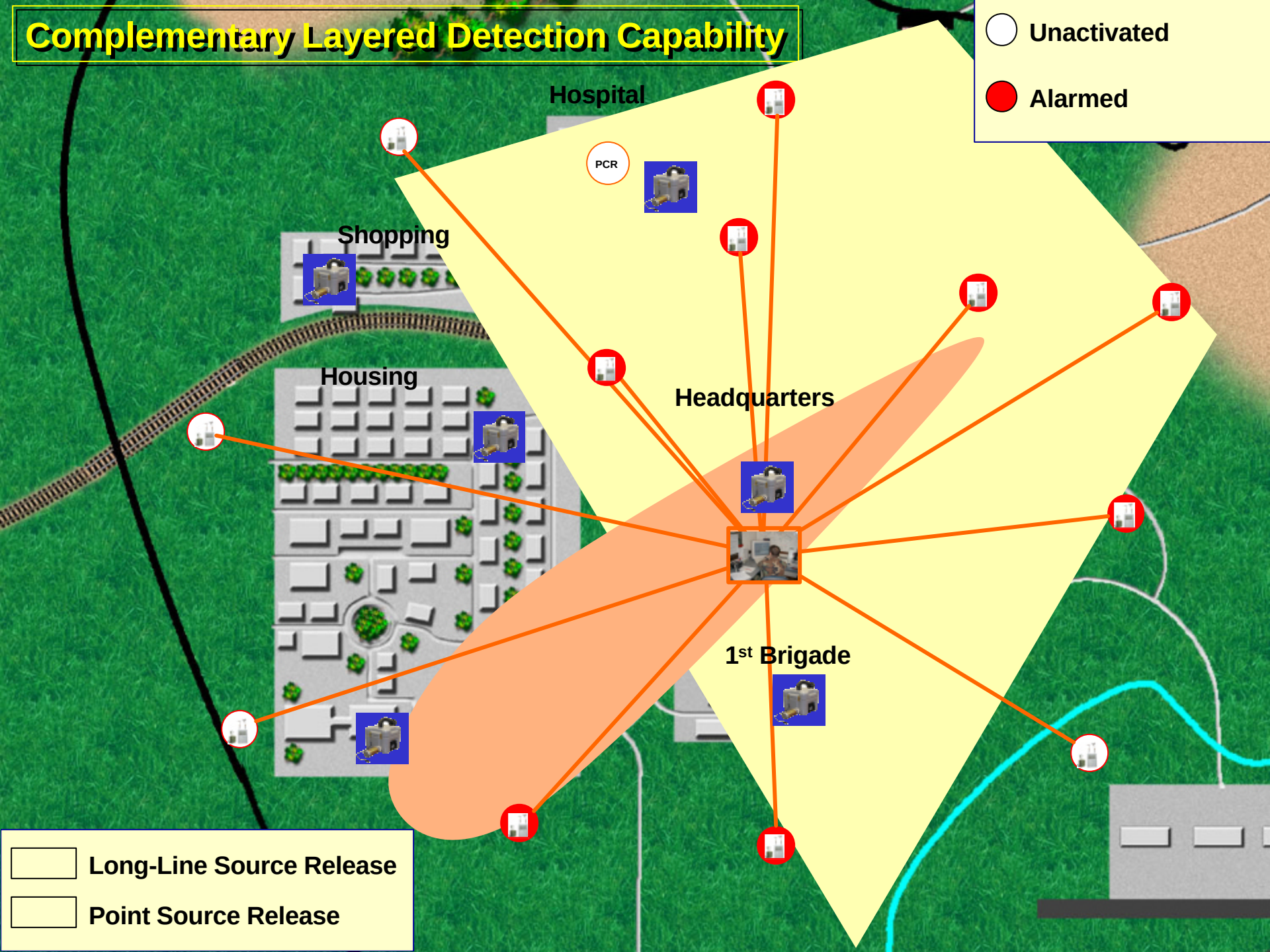
Installation Urban Protection
Some Options

Consequence Management Approach	Focuses on Installation response Limited detection and warning Medical treatment and restoration Operations are key elements Requires appropriately trained response personnel - Army Installation Support Teams (IST), 8 Regional Response Teams (RRTs) and Special Medical Augmentation Response Team (SMART)
Early Warning and Detection	Focuses on detection of an event below infectious or casualty causing levels Detection, and identification paramount Requires an integrated warning and communications capability Relies on individual and collective protection to limit casualties
Intelligence/meteorological Indicators (anticipatory)	Fusion of intelligence and environmental data to anticipate an attack Focus is to adopt protective measures in anticipation of an event Sensors and response requirements are minimized Require that individual protection be readily available Requires an effective communications system and a well trained populace

Installation/Urban Protection
Some Options

Reactive	**Focuses on the ability to respond to and treat an event** **Medical surveillance and identification are key** **Requires the stockpiling of appropriate medical countermeasures** **Relies heavily on first responders for ID and treatment** **Relies on regional or national assets for installation restoration**
Integrated Chem/Bio/Med Response	**Focuses on a holistic approach** **Requires the integration of intelligence detection, warning, and response** **Requires the establishment of a central operations center to control and implement** **Requires the availability of trained response personnel to include medical** **More emphasis placed on installation capabilities vice external response**


Generic Installation
Training Area
Gate
Shopping
Housing
Headquarters
Training Area
1st Brigade
Airfield
Gate
Fence


Complementary Layered Detection Capability
Unactivated
Alarmed
Hospital
PCR
Shopping
Housing
Headquarters
1st Brigade
Long-Line Source Release
Point Source Release

Urban Bio-Surveillance System for NCR Goal

Deploy a dual use—military and civilian—operational capability for integrated Bio-Surveillance, Detection and Alerting, in the National Capital Region (NCR) within 18 months for Homeland Security against Bio-Terrorism/Bio-Warfare threats.

…. to Improve Decision Cycle and Increase Situational Awareness

PUT INVESTMENTS <u>TO USE</u> FOR LARGER POPULATION!

Urban Bio-Surveillance System for NCR

Proposed Program

- **Integrated Information Network and Alerting System for BW Threat**
- **Traditional Detection Using Environmental Sampling/Sensors *and* Non-Traditional Detection Using Health, Plant, and Animal Indicators**
- **Military and Civilian Data Sources**
- **Military and Civilian Users**
- **Flexible Command and Control Support**

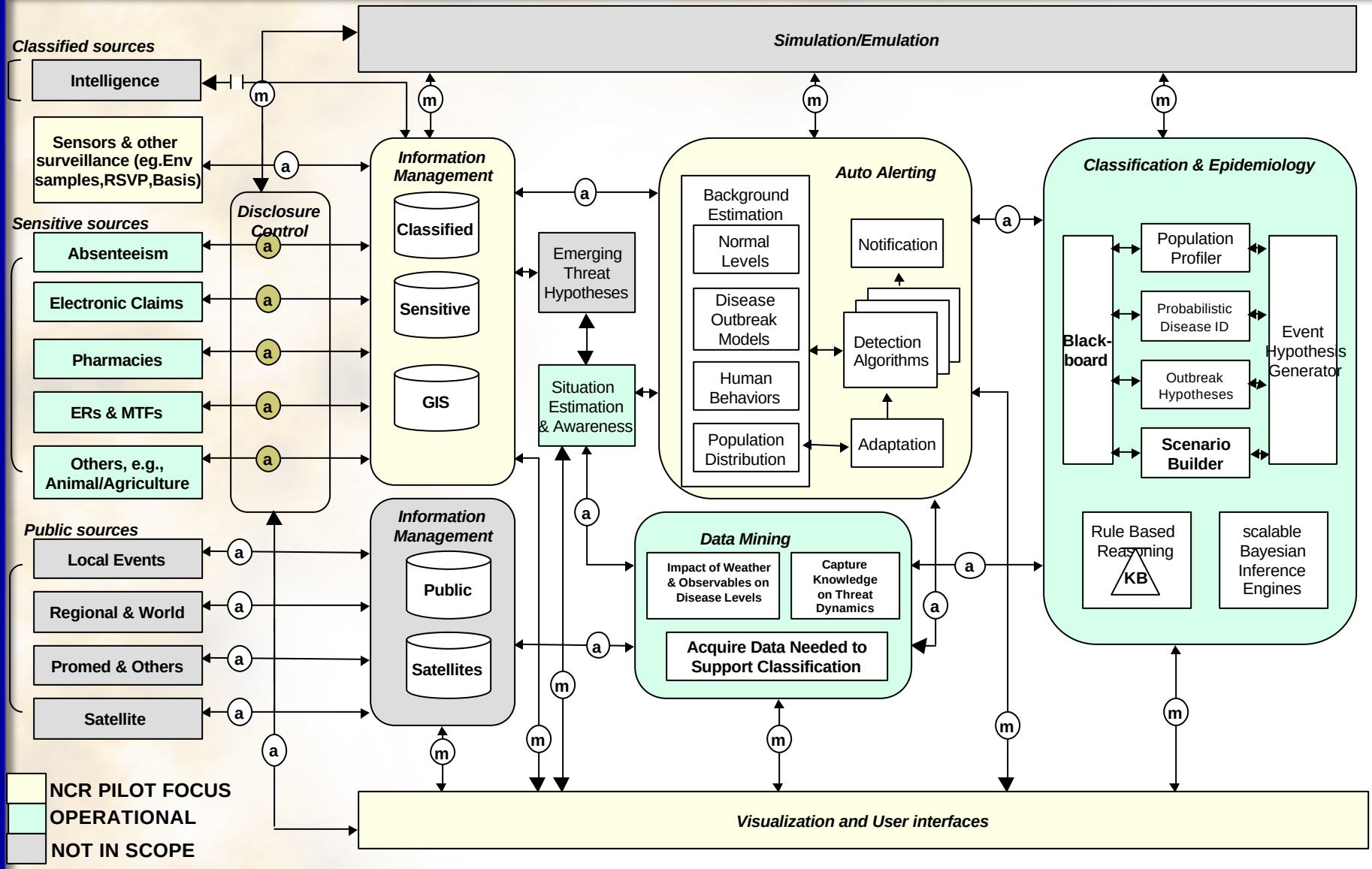
…. leverages PROVEN technologies; complements existing technologies; and can incorporate and benefit from those yet to come

Urban Bio-Surveillance System for NCR
Key Program Elements*

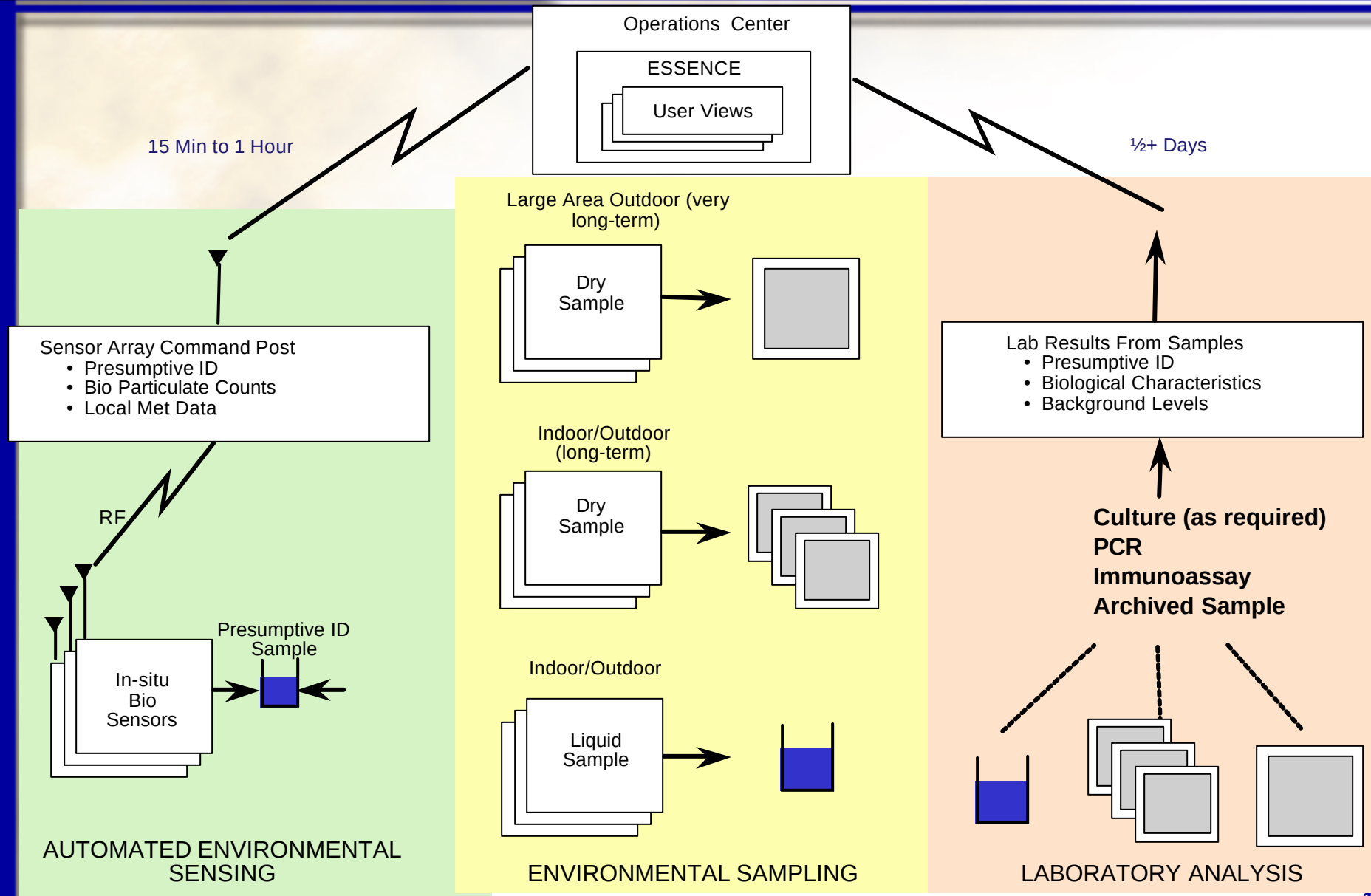
- BWA Detectors (Portal Shield, PCR, others)
- Environmental Collections/Sampling
- Sample Analysis
- Background Characterization
- Non-Traditional Data Sources Collection
- Alerting/Detection Algorithms and Data Analysis
- IT, GUI
- Comms and Security
- CONOPS and Data for Standards Development
- T&E, Demonstration
- Supporting Technology Development/Transition
- Fielding, Training & Logistics Support

*Components of the Detailed Program Plan/SOW

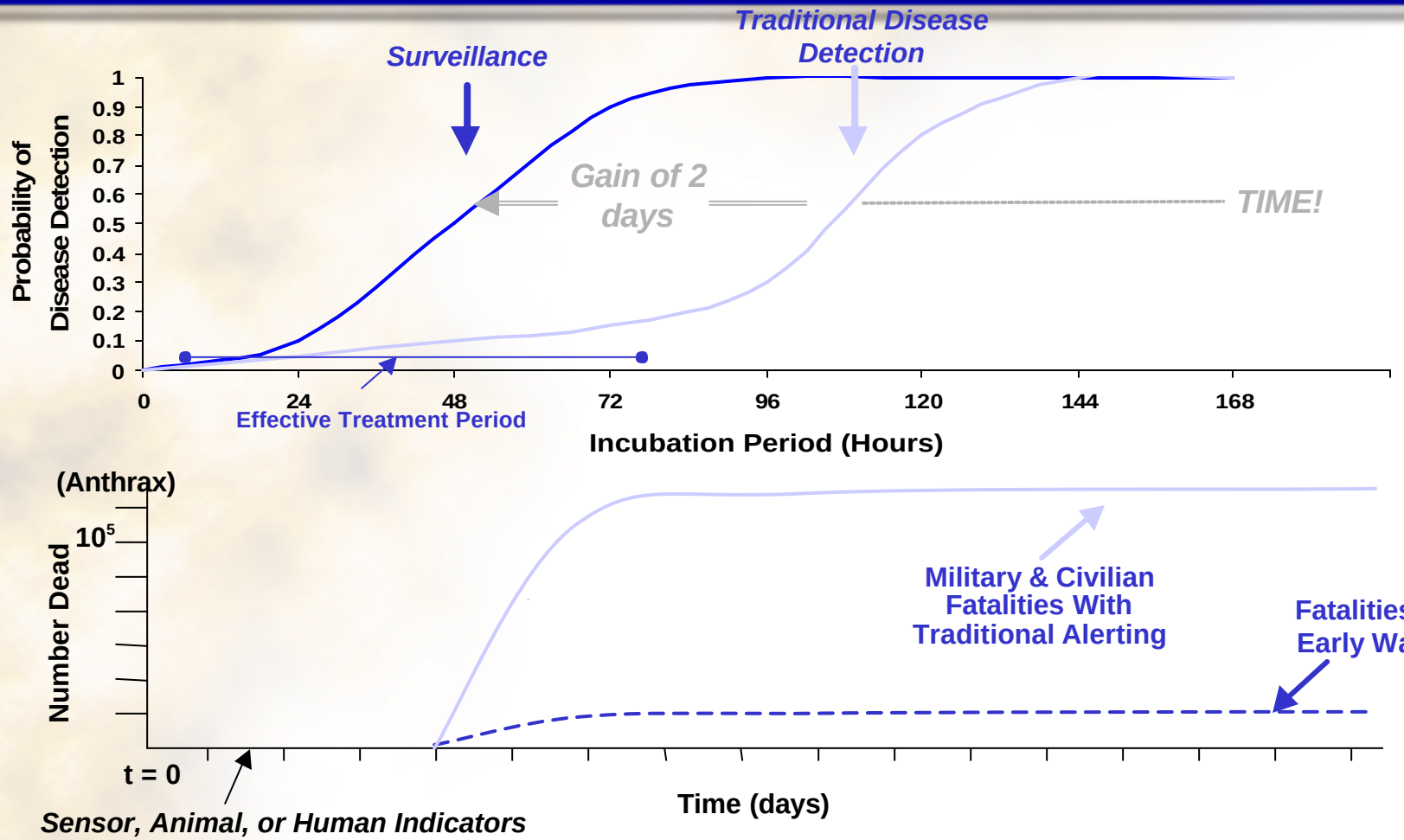
ESSENCE II Functional View



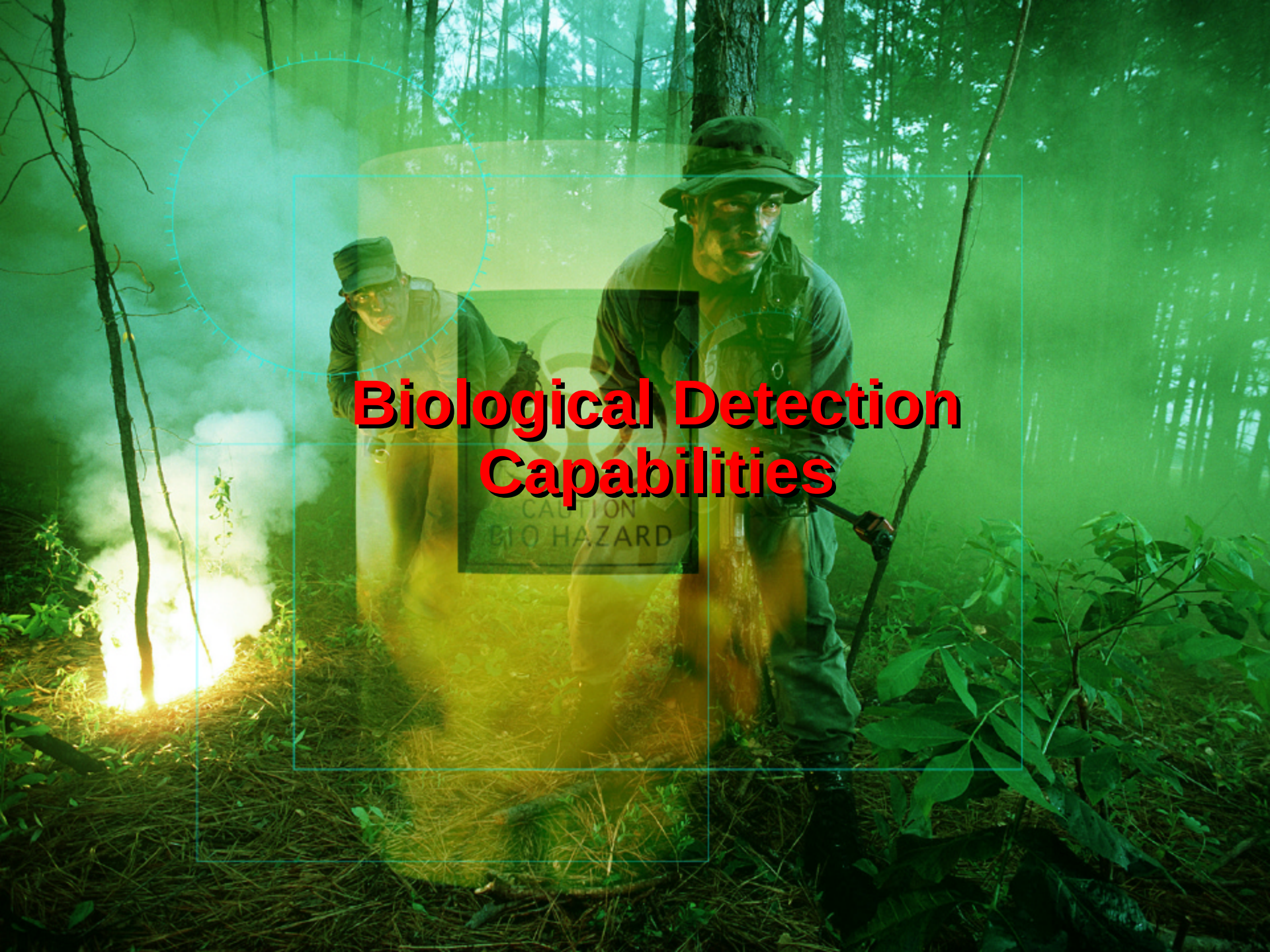
Integrating Health Surveillance and Sensors Approach



So What Does Bio-Surveillance Buy ?



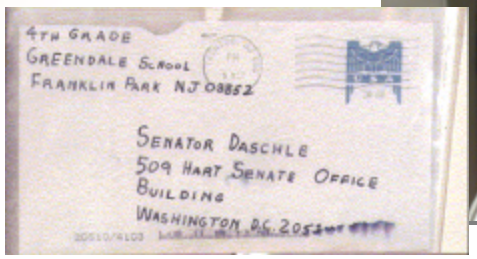
BOTTOM LINE: Gain of two days allows for an earlier, more informed public health and law enforcement response (e.g. start treatment, clear beds, etc.)



Biological Detection Capabilities

DoD Biological Sampling Kit

- **Presumptively Identification of BW Agents:**
  - **Contamination Detection After a BW Attack**
  - **Quick Screen of Suspect Packages/Samples (Analogous to M8 Paper)**
- **Contents**
  - **Panel of 8 HHAs (9 available)**
  - **Conical Tube Containing:**
    - **Bottle of Buffer Solution**
    - **Sterile Cotton Swabs**
  - **Basic Instructions**
- **Cost: $52**
- **Good Shelf Life**
- **One-Time Use Only**
- **Training Kits and Interactive Training CD-ROM Available**



Training CD-ROM

Never Used as the Sole Basis for Agent Identification
Not for Diagnostic Use

Used by Capitol Police to Positively Identify Senator Daschle letter!

Dry Filter Unit
Collector/Concentrator Air Sampler

Dry Filter Sampler Evolution

Sept 30th

Urban Design

Oct 13th

3-Filter Field Design

HVAC Design

Nov 1st

Man Portable

Office Design

Mobile Design

- *"Fixed Site/First Responder Application"*
- ID 10 BW Agents
- ID Time, 15 minutes w/ HHA
- Compatible with Standard Bio Analytical Techniques (e.g., HHAs, ELISA, PCR, etc.)
- Simple to operate, minimal Training (15 min) & Maintenance Required
- Systems: 225 units

Developed & Deployed Over 100 Units in Less than 90 Days!

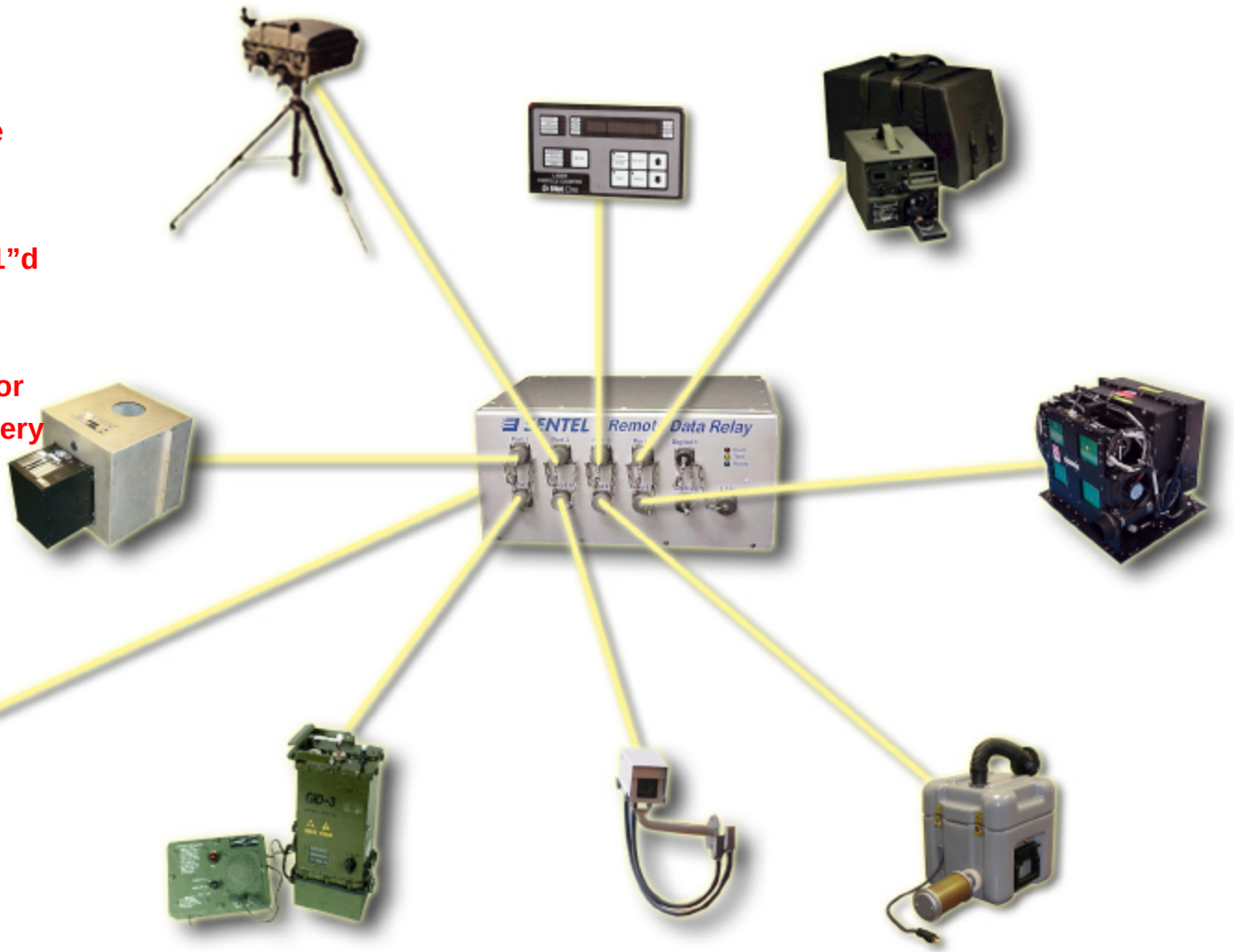
Dry Filter Unit (DFU)

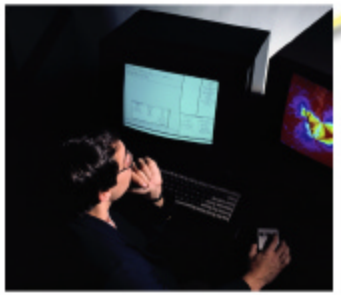
- Portable : 42 lb
- Quiet: ≤ 60 db @ 2 feet
- Low Cost: $ 1000 each
- Rugged: -20°F - 120°F
- Highly Reliable: 40,000 hr motor life
- Weather Tight
- Requires Minimal Training and Maintenance
- Maintenance Concept: Dispose and Replace

Dry Filter Unit Kit (DFU Kit)

Remote Data Relay (RDR)

- Ethernet or RF Communication
- 8 Input Ports
- Operating Temperature 20°F-120°F
- Weight: 23 lbs
- Size: 7.5”h x 16”w x 11”d
- Weather-tight
- Power: 85-264 VAC Universal Commercial or 10-30 VDC Vehicle/Battery





Joint Biological Point Detection System (JBPDS) Applications

JBPDS Consistently Demonstrates Top Performance & Greatest Operational Flexibility

Joint Portal Shield
(Formally Airbase/Port Bio Detection ACTD)

Portal Shield Sensor

- DOD's First Automated Network System
- Detects 8 Agents Simultaneously
- Network Detection <25 Minutes
- Easy Operator "Plug and Play" Modules
- Chemical Sensor(s) Interface
- Ethernet Interface

Chemical Sensor

Complete System w/ Generator

Air Intake; Weather Station; Radio Antenna; Temperature Probe; GPS

Command Post

Fielded to 21 Sites Overseas

Confirmatory Testing

Notional systems shown

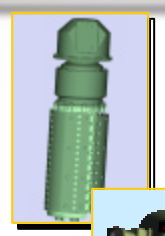
PCR

Immunoassay

- **Rapid Bio Agent Identification**
- **Provide Medical Personnel With an Organic, Rapid Identification Capability**
- **Medical Surveillance Testing (not FDA approved for diagnostics)**
- **COTS/NDI Pre-JBAIDS Technology**

Urban Chem/Bio Surveillance and Response Emerging Technologies

- Emerging Technologies 24-36 months
  - Joint Service Lightweight Standoff Chemical Agent Detector
  - Joint Biological Stand-off Detection System
  - Joint Chemical Agent Detector
  - Joint Service Fixed Site Decon



JSLSCAD

JBSDS

JCAD

- Multimission Emerging Technologies 24-36 months
  - Software upgrades to provide automated response capability

- Emerging Technologies That Can Be Accelerated
  - Improved Trigger Capabilities – Advanced BAWS
  - Portable Assay Reader
  - Improved Aerosol Collectors
  - Medical Surveillance
  - Additional Vaccines

Urban Chem/Bio Surveillance and Response – EQUIPMENT AVAILABLE NOW

Bio Detection

JBPDS
$480K
6 month lead

DFU
$1K
In Production

Portal Shield
$285K
4 month lead

PBAS
$25K
2 month Lead

Bio-Sampling Kit
$52.00
In Prod.

Chem Detection

M22 ACADA
$11K
In Production

ICAM
$4K
In Production

M21 RSCAAL
$148K
Out of Production

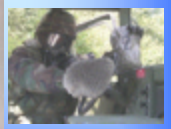
Radiac Sets
$8K
In Prod.

Chem/Bio Detection

Enhanced LPR-20
(Pps-5D Equivalent)
$90K
In Production

Decontamination

Modular Decon System
$26K
In Production



Sorbent Decon System
$60/100
In Production

Urban Chem/Bio Surveillance and Response – EQUIPMENT AVAILABLE NOW

Protection

M40A1
$112.00
In Production

M45
$400.00
In Production

JLIST
$275.00
In Production

M42A2
$330.00
In Production

Chem/Bio Response

Emergency Response Vehicle
$900K
COTS

Mobile Information/Analytical Technologies

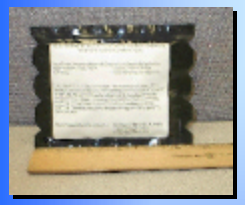
Unified Command Suite
$1.5M
In Production

Mobile Lab
$1M
COTS

Medical Systems

Ruggedized Advanced Pathogen Identification Device (RAPIDS)
$55K
COTS

Nerve Agent Antidote Kits (NAAK)/
$12.25
In Production



Skin Exposure Reduction Paste Against Chemical Warfare Agents (SERPACWA)
$14.31
In Production

Convulsant Antidote for Nerve Agents (CANA)
$10.44
In Production

TECHNOLOGY READINESS EVALUATIONS

Joint Science & Technology Panel for Chemical Biological Defense Technology Base (October 2001)

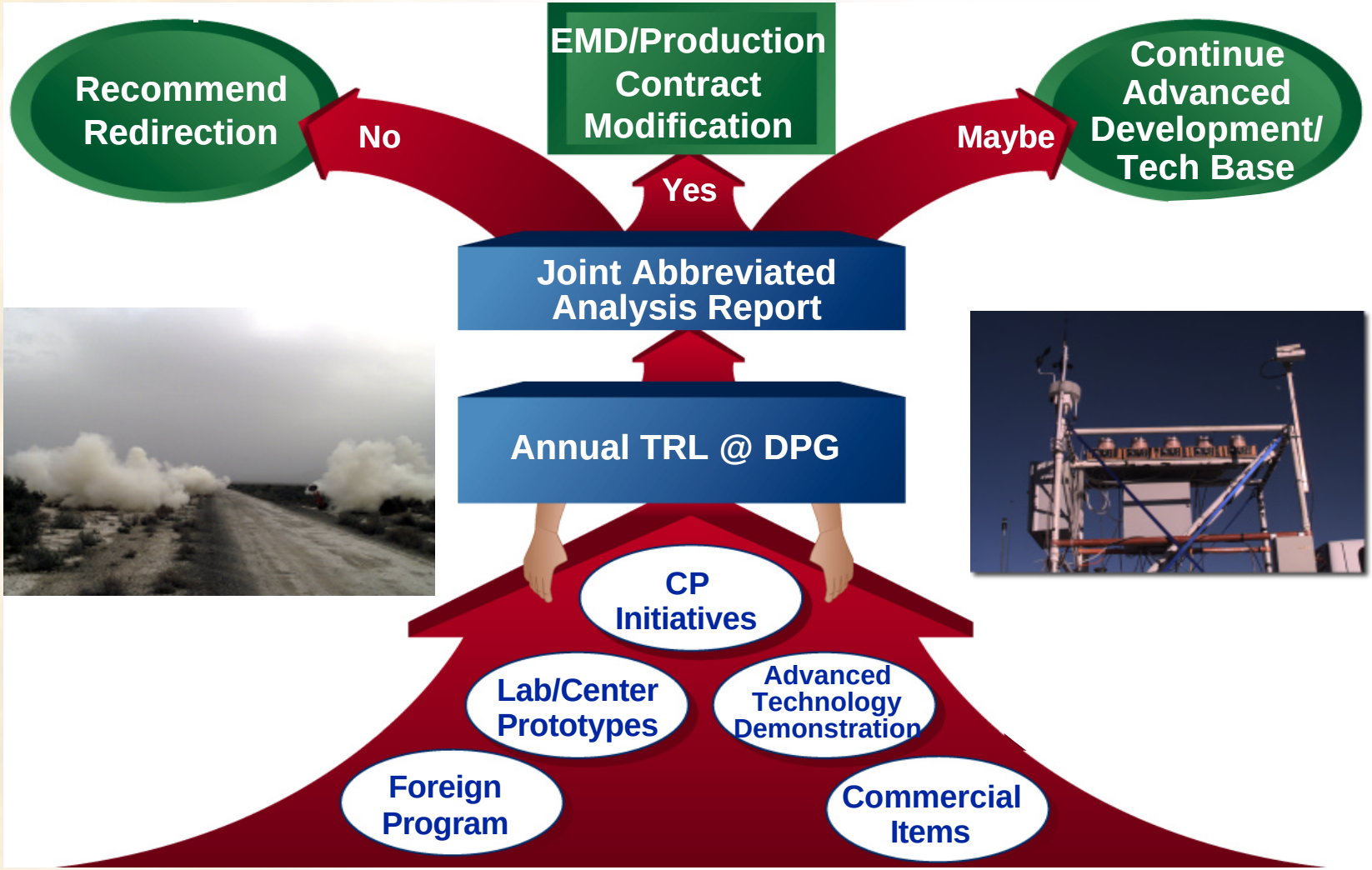
- **TRE (formerly known as JFTs) Charter: Identify new/emerging technologies**
  - Bio defense development programs
  - Bio defense Advanced Concept Technology Demonstrations
  - Fielded bio defense system upgrades
- **Key players**
  - Tech Base
  - PEO-CBD
  - Joint Service Integration Group
  - Dugway Proving Ground
  - Defense Operational, Test and Evaluation Command
- **International test facilities/cooperative efforts**
  - *Defense Research Establishment Suffield (DRES)/JFT-6*
  - *Defense Science & Technology Laboratory (JFT-7)*

Technology Readiness Evaluation Elements

Test Elements

- **Outdoor Field: Point and Standoff Detection**
  - **Probability of Detection**
- **Aerosol Simulant Exposure Chamber: Collection Efficiency**
  - **Concentration Factor**
- **Laboratory: Identification**
  - **Sensitivity**
  - **False Positive Rate**

Technology Transition Process



JFT Past Participants

- Biological Aerosol Trigger (BAT) - SBCCOM
- Biological Attenuation System (BAS) - Battelle
- Bidiffractive Grating Bio-Identifier (BDG, later to be known as the LAI) – Battelle
- BioCapture™ (BT-550) – MesoSystems Technology, Inc.
- Biological Aerosol Warning System (BAWS) – Loral, Met One
- Biological Inertial Collector/Concentrator - Battelle
- Biological Laser Aerosol Sampling Time-of-Flight Mass Spectrometer (BLASToF) – JHU/APL
- Canadian Integrated Biological Agent Detector System (CIBADS) – DRES/Computing Devices Canada
- Carousel Liquid Sampler (CRLS) - SBCCOM
- Cauldron Silicon Chip Biosensor (Cauldron) – TRW / Microredux, Inc.
- Chemical Biological Mass Spectrometer Block I (CBMS) – Bruker Analytical Systems
- Chemical Biological Mass Spectrometer Block II (CBMS 2) - SBCCOM
- Compact LIDAR (Compact) – SBCCOM/ECBC
- Dendrimer Hand-Held Assay (ARL-HHA) - ARL
- FACSCalibur Flow Cytometer (FACS) – Science & Technology Corp.
- Fluorescent Aerodynamic Particle Sizer (FLAPS) – DRES/TSI/Dycor
- Force Differentiation Assay (FDA, later to be known as the Force Differentiation Biosensor) - NRL
- Force Differentiation Biosensor (FDB, formerly known as the Force Differentiation Assay) – NRL
- French Cyclone (FrCY) – CBDE Porton Down, UK
- Hand-Held Assay – NMRI, Majesco/Princeton Biomeditech, SA Scientific
- High Volume Aerodynamic Particle Sizer (HVAPS) - TSI
- High Volume Virtual Impactor – Ministry of Defence (MOD), UK
- Hybrid LIDAR – (Hybrid) – Electro Optics Organization (EOO) and Stanford Research Institute International
- IBADS Wetted-Wall Cyclone Sampler – Naval Surface Warfare Center
- Joint Biological Point Detection System Block I – ACAT II program currently under development
- Laboratory Attenuation Identifier (LAI, formerly known as the BDG)) - Battelle
- LightCycler PCR - NMRI
- MALSI-TOF-MS (MALDI) - SBCCOM
- Mark 1.5 (M-1.5) – Lumenal Technologies, L.P.
- Microfluidic Integrated DNA Analysis System II (MIDAS II) - Cepheid

JFT Past Participants

- Micro-Laser Bio-Aerosol Fluorescence Detector – MIT/Lincoln Laboratory
- 3550 Microluminometer (ML-4550) – SBCCOM, New Horizons
- 4550 Microluminometer (ML-4550) – Military Institute of Hygiene and Epidemiology, Poland, New Horizons
- Micro Pulse LIDAR 1000 (MPL 1000) – Science and Engineering Services, Inc (SESI)
- Micro Pulse LIDAR 2000 (MPL 2000) – Science and Engineering Services, Inc (SESI)
- Mini-Ten Chamber PCR (Ten Chamber) - DOE
- MIRELA – DGA, DCE, Centre d'Etudes du Bouchet
- MKS-90 Airsampler – Muenster Defense Labs/Federal Republic of Germany
- Multi-parameter Aerosol Particle System (MAPS) – SBCCOM
- Multi-Pas Imaging Fluorescence Sensor (MPIFS) – MIT/Lincoln Laboratory
- Origin Analyzer (Origin) – Igen, Inc./SBCCOM
- Portable Biological Aerosol Sampler (PBAS/JPO SPINCON) – Midwest Research Institute/JPO-BD
- Portable High-Throughput Liquid Aerosol Sampler (PHTLAAS) - SBCCOM
- Pyrolysis-Gas Chromatography-Ion Mobility Spectrometer (PYGCIMS) – ECBC
- Rapid Light Cycler (RAPID LC) – Idaho Technologies
- RAPTOR Plus™ (RAPTOR, formerly known as the FOWG) – Research International, Inc. / NRL
- Roche Light Cycler (Roche LC) – Roche / NMRC
- Scanometrix™ DNA Array Detector (DNA-AD) – Nanosphere, Inc
- Short Range Biological Standoff Detection System – Fibertek, Inc., SBCCOM
- Single Particle Fluorescence Analyzer (SPFA, formerly known as the SPFC) – NRL
- Single Particle Fluorescence Counter (SPFC, later to be known as SPFA) – NRL
- Smart Air Smapler System (SASS) – Research International, Inc.
- SmartCycler-G3 – SBCCOM/Cepheid
- SONDEBIO - PROENGIN
- SPINCON – Midwest Research Institute
- Ultra Violet APS (UVAPS) - TSI
- Victor$_2$ Multi-Label Counter (Victor$_2$) – PerkinElmer Wallac
- Wetted-Walled Cyclone - (JBPDS/baseline)
- XMX/2L - Dycor

Questions?


Biological Sampling Kits
15,000 Kits
Portal Shield
7 Sites Fielded
JBREWS ACTD SIU
Residual Fielding 1QFY01
BIDS
2 Companies Fielded
1999 Packard
Award Winner
Army
Navy
Air Force
Marines
NATO 50
National Special Events
Joint Field Trials
6 Trials Held
JBPDS
FUE 3QFY02
LRBSDS
3 Systems Fielded
Anthrax Vaccine
IBAD
15 Systems Shipboard